METHOD AND APPARATUS FOR RADIO RESOURCE CONTROL IN A MOBILE NETWORK

FIELD OF TECHNOLOGY

[0001] This disclosure relates generally to the field of radio resource control in a mobile network.

BACKGROUND

[0002] In mobile networks, user equipment/devices (UE) request radio resources from the Radio Access Network (RAN), and the RAN allocates the required resources to the UE for its use. If there is no activity in either the downlink or the uplink direction, the RAN reclaims the allocated resources from the UE and re-allocates them to other UEs. To attempt to achieve fairness in radio resource allocation, timers are currently used and configured based on traffic, network load, etc.

[0003] Radio Resource Control (RRC) is the protocol used to allocate and release resources for each user equipment device connected to a network. RRC has internal states and is maintained both at the UE and the RAN. For example: in 4G and LTE, RRC includes two states, CONNECTED and IDLE; in 3G wireless networks, the states are IDLE, CELL_FACH, CELL DCH, and CELL PCH; and in 4G, the RRC states are connected and disconnected. During RRC, state transitions are based on configured timers and/or the amount of data being exchanged in each state. Generally speaking, these timers are preconfigured by operators for RRC protocol and are fixed.

[0004] If these timers are not properly configured, they can poorly affect the Quality of Service (QoS) and Quality of Experience (QoE) of the user traffic. In addition, poorly configured timers can lead to an increased call set-up time due to a lack of radio resource management and can also increase signaling load on the radio network controller.

SUMMARY

[0005] In the present disclosure, a method includes: at an applications server, analyzing application flows with respect to at least one device connected to a network; at the application server, generating an adaptive timer value based on application flows of the at least one device; sending the adaptive timer value to at least one server; sending, from the at least one server, the adaptive timer value to the at least one device; and adopting, at the at least one device, the adaptive timer value.

[0006] In another embodiment of the present disclosure, a method includes: on at least one device connected to a network, initiating traffic on the network; receiving the traffic at an application server; performing an application behavior analysis at the application server; at the application server, generating an adaptive timer value based on the application behavior analysis; sending the adaptive timer value to at least one server; sending, from the at least one server, the adaptive timer value to the at least one device; and adopting, at the at least one device, the adaptive timer value.

[0007] In yet another embodiment of the present disclosure, an apparatus includes a processor configured to communicate with a network; and a memory in communication with the processor; wherein the processor is further configured to: connect the apparatus to the network; initiate traffic on the network; and adopt an adapted timer value based on the traffic initiated on the network.

DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0008] To aid in the proper understanding of the present disclosure, reference should be made to the accompanying drawings, wherein:

[0009] FIG. **1** is a diagram illustrating an example of state transition of a UE, in accordance with the present disclosure;

[0010] FIG. **2** is a flow chart illustrating a method in accordance with an embodiment of the present disclosure;

[0011] FIG. **3** is a flow chart illustrating a learning process in accordance with the present disclosure;

[0012] FIG. **4** is a flow chart illustrating a method in accordance with an embodiment of the present disclosure;

[0013] FIG. **5** is a flow chart in accordance with an embodiment of the present disclosure;

[0014] FIG. **6** is a signaling diagram illustrating a method in accordance with the flow chart of FIG. **5**;

[0015] FIG. **7** illustrates an apparatus in accordance with the present disclosure;

[0016] FIG. **8** is a graphical output in accordance with the present disclosure;

[0017] FIG. **9** is another graphical output in accordance with the present disclosure; and

[0018] FIG. **10** is yet another graphical output in accordance with the present disclosure.

DETAILED DESCRIPTION

[0019] Broadly speaking, the present disclosure provides a method and apparatus for radio resource control (RRC) in a mobile network. As will be described in further detail below, the method includes a learning process and an adaptation flow. During the learning process, an application server learns, for example, user traffic types, application behavior, time of usage, location of usage and other information with respect to each subscriber in the network. After a sufficient set of data is collected by the application server, the application server can predict future behavior of traffic for the same subscribers or for new subscribers, and adapt radio resource control elements based on application behavior of the subscribers. The application server selects appropriate timer and system parameters during this process. Accordingly, based on the present method, network performance and scalability are improved.

[0020] As indicated briefly above, RRC is configured to allocate and release resources for each UE in a network. During RRC, the UE will undergo state transitions, which are generally based on configured timers and/or the amount of data being exchanged in each state. Both 3G and 4G protocols have specified states for UEs within the network. Because the present methods and apparatus can be utilized in both 3G and 4G networks, the various states within each protocol will now briefly be described.

[0021] In 4G, there are two states: CONNECTED and DISCONNECTED. When the UE is in the CONNECTED state, it is connected to the network; and in the DISCONNECTED state, the UE is idle or not connected to the network. In 4G LTE, the specified states are CONNECTED and IDLE. While in the IDLE state, the UE is turned "on" but is disconnected from the network. In this state, there is no RRC connection between the UE and the network. In